Co-evolution of clay-sized organic and mineral constituents during initial soil formation

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Clay fractions from a soil chronosequence (Switzerland) after retreat of the Damma glacier (15, 75 and 120 yrs) and from mature soils outside the proglacial area (> 700 yrs) were used to elucidate the evolution of organo-mineral assoziations during initial soil formation.

The chemistry of clay-bound organic matter was assessed by ^{13}C NMR spectroscopy and the contents of amino acids and neutral sugar monomers were determined by acid hydrolysis. The mineral phase was characterized by X-ray diffraction, oxalate extraction, N_2 adsorption, and cation exchange capacity at pH 7 (CEC_{pH7}), before and after H_2O_2 treatment.

The OC loading of the clay fractions strongly increased within about 100 yrs of soil formation. This resulted in decreasing specific surface area (SSA) of the mineral phase and increasing CEC_{pH7} which is in line with XRD analysis as no significant transformations of clay minerals were detected. The SSA of H_2O_2-treated clay fractions were strongly related to oxalate soluble Fe (Fe_o) and a strong correlation was found between increasing contents of Fe_o and OC with soil age.

Clay-bound OC of the 15-year-old soils was of refractory nature owing to high proportions of carboxyl C and aromatic C which may be ascribed to inherited OC. With increasing age (75 and 120 yrs), the relative proportions of carboxyl and aromatic C decreased. This was mainly associated with increasing O-alkyl C proportions, whereas accumulation of alkyl C is detected only in the mature soils. These findings are in line with the amounts of carbohydrates which were predominantly derived from microbial input. Proteins accumulated to a similar extent as carbohydrates and H_2O_2 resistant OM showed very low C/N ratios.

The formation of organo-mineral associations starts with the sorption of microbial-derived proteinaceous compounds and carbohydrates on mineral surfaces which are mainly provided by ferrihydrite. The sequential accumulation of different organic compounds and the large OC loadings point to layering of OM during the evolution of clay fractions.

Composition of error in LA-ICP-MS U/Pb geochronology: Lessons from the processing of standard measurement series performed in ten laboratories

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We have studied the error propagation and the composition of the error of the calculated U/Pb ages of standards measured in ten laboratories by laser ICP-MS technique. These laboratories used different mass spectrometers, laser cells and instrumental settings. The data reduction was performed by several alternative methods e.g. using Arithmetic Mean of Ratios (AMoR), Ratio of Means (RoMa), Median and regression methods and the residual errors of these procedures were compared. The effect of outlier rejection using the standard 2-sigma method and an iterative outlier-testing method was also studied.

Beyond the classical measures of the precision of the age like concordance we performed several experiments to express the scatter of the data obtained by the the laser ablation.

The so called Extra Poissonal Error is recommended for the optimization of the dwell times of the analytes.

The ratio of the mean and the Tzero intercept (of regression) gives a more robust measure for the fractionation than the ratio of the means of first half / second half of the ablation signal.

The influence of the drift through a measurement session was also studied.

The calculations were performed by the UranOS software: www.sediment.uni-goettingen.de/staff/dunkl/software/